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(54) DRUM FOR MAKING TYRES WITH RADIAL PLY CARCASSES

(71) We, ZELANT, GAZUIT, a Société Anonyme organised under the French Laws, of Chemin Chauveau, 03108 — Montlucon, France, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to a drum for making tyres with radial ply carcasses.

Drums are known for manufacturing radial ply tyre carcasses which have a cylindrical surface on to which an elastic wall is applied which supports the radial plies of the carcass the drums being provided with means intended to progressively change the cylindrical surface into a toroidal surface corresponding to the inner surface of the tyre to be made by a gradual mechanical spreading out of the surface.

It is known to provide a drum for making tyres with radial ply carcasses of the type comprising a hollow shaft, two annular supports slidable on the hollow shaft, a rotatable threaded shaft mounted in the hollow shaft and having two screw threads of equal but opposite pitch, two nuts threaded respectively on to the screw threads of the threaded shaft and linked respectively to the slidable annular supports by connecting pieces slidable in axial slots formed in the hollow shaft, curved shaping segments circumferentially distributed about the hollow shaft, a segment carrier for each shaping segment, a plurality of pairs of similar arms, equal in number to the number of segment carriers and circumferentially distributed around the hollow shaft, the arms of each pair extending substantially radially and being pivotally connected one to the other on a common pivot slidably mounted in a radially extending rectilinear slot in an associated segment carrier, the arms of each pair being pivotally connected at their radially inner ends respectively onto the slidable annular supports and at their radially outer ends onto the associated segment carrier respectively by means of rods slidable in axially extending slots of the carrier, and a tubular elastic membrane covering all the segments.

The invention provides a drum for making tyres with radial ply carcasses of the type comprising a hollow shaft, two annular supports slidable on the hollow shaft, a rotatable threaded shaft mounted in the hollow shaft and having two screw threads of equal but opposite pitch, two nuts threaded respectively on to the screw threads of the threaded shaft and linked respectively to the slidable annular supports by connecting pieces slidable in axial slots formed in the hollow shaft, curved shaping segments circumferentially distributed about the hollow shaft, a segment carrier for each shaping segment, a plurality of pairs of similar arms, equal in number to the number of segment carriers and circumferentially distributed around the hollow shaft the arms of each pair extending substantially radially and being pivotally connected one to the other on a common pivot slidably mounted in a radially extending rectilinear slot in an associated segment carrier, the arms of each pair being pivotally connected at their radially inner ends respectively on to the slidable annular supports and at their radially outer ends on to the associated segment carrier respectively by means of rods slidable in axially extending slots of the carrier, and a tubular elastic membrane covering all the segments, wherein the segments are each provided with alternate axially extending projections and indentations shaped so that when the pairs of similar arms are in a radially contracted

ANNEX

position the said projections and indentations on adjacent segments interdigitate with one another.

Preferably each of the segments is made up of a central part fixed in a detachable manner on the associated segment carrier, and two lateral extensions, which are connected respectively to the edges of the central part of the segment so that they are able to pivot freely in axial planes, the edges of each segment carrier presenting abutment surfaces to limit the pivoting movements of the lateral extensions towards one another in the fully radially expanded position of the drum, the outer face of the central part of each segment and its lateral extensions having the same profile as that of the inner surface of the tyre to be shaped when the said extensions abut against the edges of the associating segment carrier.

Preferably the drum comprises in addition two annular members slidably mounted on the hollow shaft and arranged on respective sides of the slidable annular supports, two bead clamping devices carried respectively by the annular members, each bead clamping device consisting of several radially movable bead clamps, circumferentially distributed around the associated annular member, two devices enabling materials used in the making of the tyre to be turned over around bead core assemblies held by the bead clamping devices, each turning device being carried respectively by one of the two annular members and consisting of several elements circumferentially distributed around the associated annular member and each being pivotable around an axis substantially parallel to a plane through the centre of the drum and normal to the axis thereof, each of the turning devices having at least one pivoting element comprising a pivoting arm connected at one end on to an associated annular member and made up of several flexible strips fixed at one end at a common point on to the associated bead clamp and at an opposite end at respective points spaced along the pivoting element.

The invention will now be described further by way of example with reference to the accompanying drawings in which:

Figure 1 is a view in axial cross-section of the drum showing, in the lower part of the figure, the said drum in a radially contracted position and in the upper part of the figure, the drum in a fully radially expanded position, and

Figure 2 is a partial view to a larger scale than that in figure 1 showing only some of the segments and their control arms, in said radially contracted position in the lower part of the figure and in said fully radially expanded position in the upper part.

The tyre making drum shown in figure 1 comprises a hollow shaft 1 on which can slide two annular supports 2*a* controlling several pairs of similar arms 3 which cross each other while supporting the curved pre-shaping segments 4 which are distributed regularly and circumferentially around the drum and covered with an elastic tubular membrane 5.

A rotatable, threaded shaft 6 mounted in the hollow shaft 1 and having two screw threadings of equal but opposite pitch, symetrically arranged in relation to the median transverse plane XX of the drum, cooperates with two nuts 2*b* which are connected respectively to the supports 2*a* by the intermediate means of connecting pieces 2*c* which can slide in axial slots 1*a* formed in the hollow shaft 1. Means (not shown) are provided to drive the screw 6 selectively in one or the other direction of rotation. Thus every rotation movement of the screw 6 compels the supports 2*a* to slide in opposite directions symmetrically on either side of the median transverse plane XX of the drum.

The drum consists in addition of two bead-clamping devices 7 which can be selectively moved towards or away from the drum's median transverse plane XX in synchronism with the movements of the two supports 2*a*. Each bead-clamping device 7 consists of several bead-clamps 7*a* radially movable and circumferentially distributed around the drum. The edges of the tubular elastic membrane 5 are respectively fixed to the bead-clamps 7*a* of the two bead-clamping devices 7.

The pairs of arms 3 are circumferentially disposed around the axis of the drum and the two arms of each pair are connected at one end respectively onto the supports 2*a* and at their other end on a segment-carrier 8 by means of rods 11 which are connected to rollers which can slide in slots 12 extending longitudinally in the associated segment-carrier 8, and symmetrically arranged in relation to the median transverse plane XX of the drum. Each pair of arms 3 is associated with a segment-carrier 8, and each segment-carrier 8 is associated with a curved shaping segment 4. In addition the arms 3 of each pair of arms are pivotably connected to each other by means of a common pivot 9 slidably mounted in a rectilinear slot 10 extending radially in the associated segment-carrier 8. Thus, the segment-carriers 8 and the associated segments 4 can be selectively and radially moved outwardly or inwardly by the action of the arms 3 when the two arms of each pair are selectively brought together or moved apart from one another by the supports 2*a* moved by the screw 6.

Each curved shaping segment 4 comprises a central part 4*a* fixed in a detachable manner onto the associated segment-carrier 8 and two lateral extensions 4*b* which are connected respectively at the ends of the central part 4*a* of the segment by means of rods 4*c* in such a way as to be able to pivot freely in planes passing through the axis of the drum. As the upper part of figure 1 shows, the ends of each segment-carrier 8 constitute abutment surfaces in order to limit the pivoting movements of the lateral extensions 4*b*, one towards the other and towards the drum's median transverse plane XX in the latter's fully radially expanded position. In addition, as is also shown in the upper part of figure 1, in the drum's fully radially expanded position, the outer face of central part 4*a* of each segment 4 and of the lateral extensions 4*b* has the same profile as that of the inner surface of the tyre to be shaped when the said lateral extensions 4*b* abut against the edges of the associated carrier 8. When the supports 2*a* and the bead-clamping devices 7 are at their most separated position, as is shown in the lower part of figure 1, the elastic tubular membrane 5, which has a median bead 13 fitted in notches of the various segments 4 in the drum's median transverse plane XX, is stretched between the bead-clamping devices 7 so as to make a cylindrical surface. However, when the arms 3, moved by the bed plates 2*a*, are brought towards each other and towards the drum's median transverse plane XX, the segment carriers 8 are radially displaced outwardly moving the segments 4 with them until the lateral extensions 4*b* of these segments abut against the edges of the segment-carriers 8, as is shown in the upper part of figure 1. At this moment, the elastic tubular membrane 5 takes on the shape of the exterior profile of the sectors 4, which profile corresponds exactly to that which it is desired is given to the interior surface of the tyre to be made.

In order that the elastic tubular membrane 5 is sufficiently supported, in both the fully radially expanded and contracted positions of the drum, the central part 4*a* and the lateral extensions 4*b* of each of the segments 4 is provided with alternate axially-extending projections and indentations shaped so that when the pairs of similar arms 3 are in a radially contracted position the said projections and indentations on adjacent segments, interdigitate with one another as shown in Figure 2. The interdigitation does not allow any gaps between the segments 4, the effect of which would be for the elastic tubular membrane 5 to be insufficiently supported with the consequent risk of uneveness in the interior surfaces of the tyre in the process of shaping.

Such an arrangement is most particularly useful in the manufacture and shaping of tyres with a metal radial carcass.

In fact, the toroidal form in the curved position of the drum makes up a rigid pressure surface and one which will not lose its shape. The pressure surface allows the constituent elements of the outer cover of the tyre to be assembled in ideal conditions. The zig zag form of the lateral edges of the segments 4 ensures the desired continuity. Notably, each stranded wire of the carcass is supported by a series of pressure points each distanced, at the most, by half the spacing distance of a projection along the wire.

In the radially contracted position of the drum, as is shown in the lower part of figure 2, the projections of each of the segments 4 are substantially in contact with indentations of neighbouring segments along their entire length, whilst in the fully radially expanded position of the drum, as is shown in the upper part of figure 2, only the tips of the projections of the central part 4*a* of each segment or of its extensions 4*b* interdigitate with the tips of the projections of the central part or of the extensions of the neighbouring segments 4. No radial plane exists which does not alternately meet at least the tips of a single segment or of two contiguous sectors.

The bead-clamping devices 7 are carried, in self known manner, respectively by two annular members 14 which are slidably mounted on the hollow shaft 1 and are arranged on either side of the two slidable supports 2*a*. Each annular member 14 comprises a complex jack body 15 in which are arranged three annular co-axial chambers. The first of the three chambers, beginning at the axis of the drum, houses the head of an annular piston 16, the rod of which is rigidly fixed to the hollow shaft 1. The second annular chamber houses three annular pistons 17, 18 and 19. The piston 19, whose rod is turned towards the drum's median transverse plane XX, controls the radial movements of the various bead-clamps 7*a* of the bead-clamping device 7, carried by the same annular member 14, by the intermediate means of pivoting bell crank levers 20. The third annular chamber houses an annular piston 21, whose rod, turned towards the drum's median transverse plane XX, controls the pivoting movements of a turning device 22 allowing the materials in the making of the tyre to be turned over around bead core assemblies held by the bead-clamping device 7. The supply of compressed fluid, preferably compressed air, in one or the other of the two cham-

bers defined by the fixed annular piston 16 in the first annular chamber inside the complex jack body 15 controls the movements of the member 14 towards the median transverse plane XX or in the direction away from this plane.

The symmetry of movement of the two annular members 14 in relation to the median transverse plane XX is ensured, in self known manner, by two racks (not shown) which are each rigidly fixed to a respective member 14 so as to extend parallel to the hollow shaft 1, and which mesh with a pinion (not shown) which is freely rotatably mounted on a rod fixed transversely onto the hollow shaft.

As is shown in figure 1, the end of each annular member 14 which is turned towards the drum's median transverse plane XX carries the bead-clamping device 7. Each bead-clamp 7*a* of the bead-clamping device 7 is mounted radially movable in relation to the annular member 14 by means of a rod 7*b* slidable in a respective hole 14*a* radially cut in the end of the annular member 14. Each bead-clamp 7*a* is controlled by a respective bell crank lever 20 pivotally mounted on the annular member 14 by means of a rod 23. One of the two arms of each bell crank lever 20 is engaged in a notch cut in the end of the rod of the annular piston 19, while the other arm of each crank lever 20 is engaged in a notch in the slidable rod 7*b* of the associated bead-clamp 7*a*. Each bead-clamp 7*a* is also associated with another rod 7*c* which ensures its guidance.

Each of the two turning devices 22 carried respectively by the annular members 14 comprises several arms 24, spaced circumferentially around the drum and pivotally mounted at one end on the complex jack body 15 by means of rods 25. At its end nearest to its point of connection, each arm 24 is formed into a toothed sector 26 which meshes with a rack 27 cut on the rod of the piston 21 housed in the third annular chamber of the complex jack body 15. Thus, the supply of compressed fluid, preferably of compressed air, in one or the other of the two chambers defined by the piston 21 in the third annular chamber controls the pivoting movements of the arms 24 between the position shown in the lower part of figure 1 and the position shown in the upper part of the same figure. Several short levers 28 are connected to each arm 24 at points spaced along the latter. Each arm 24 is associated with several flexible strips 29, which are fixed at one end to a common point on the corresponding bead-clamp 7*a* and are connected at their other end respectively to the short levers 28. Thus in the radially contracted position of the drum, as is shown in the lower part of figure 1, each arm 24 and the short levers 28 are aligned parallel to the axis of the drum and the strips 29 superpose each other and the arms 24 in this alignment. At the beginning of the expanding movement of the drum towards the position for shaping the tyre, as is shown in the upper part of figure 1, small levers 30 elastically push the parts of the flexible strips 29 which are next to the ends fixed in the bead-clamps 7*a* towards the median transverse plane XX and outwardly in relation to the axis of the drum. In the course of the expanding movement the action of the different flexible strips 29 is superposed in the region of the tyre closest to the bead, a region which is where the effort necessary for building the tyre is the most important.

WHAT WE CLAIM IS:—

1. A drum for making tyres with radial ply carcasses of the type comprising a hollow shaft, two annular supports slidable on the hollow shaft, a rotatable threaded shaft mounted in the hollow shaft and having two screw threads of equal but opposite pitch, two nuts threaded respectively on to the screw threads of the threaded shaft and linked respectively to the slidable annular supports by connecting pieces slidable in axial slots formed in the hollow shaft, curved shaping segments circumferentially distributed about the hollow shaft, a segment carrier for each shaping segment, a plurality of pairs of similar arms, equal in number to the number of segment carriers and circumferentially distributed around the hollow shaft the arms of each pair extending substantially radially and being pivotally connected one to the other on a common pivot slidably mounted in a radially extending rectilinear slot in an associated segment carrier, the arms of each pair being pivotally connected at their radially inner ends respectively on to the slidable annular supports and at their radially outer ends on to the associated segment carrier respectively by means of rods slidable in axially extending slots of the carrier, and a tubular elastic membrane covering all the segments, wherein the segments are each provided with alternate axially extending projections and indentations shaped so that when the pairs of similar arms are in a radially contracted position the said projections and indentations on adjacent segments interdigitate with one another.

2. A drum as claimed in claim 1 in which each of the segments is made up of a central part fixed in a detachable manner on the associated segment carrier, and two lateral extensions, which are connected respectively to the edges of the central part

of the segment so that they are able to pivot freely in axial planes, the edges of each segment carrier presenting abutment surfaces to limit the pivoting movements of the lateral extensions towards one another in the fully radially expanded position of the drum, the outer face of the central part of each segment and its lateral extensions having the same profile as that of the inner surface of the tyre to be shaped when the said extensions abut against the edges of the associating segment carrier.

3. A drum as claimed in claim 1 or claim 2 comprising in addition two annular members slidably mounted on the hollow shaft and arranged on respective sides of the slidable annular supports, two bead clamping devices carried respectively by the annular members, each bead clamping device consisting of several radially movable bead clamps, circumferentially distributed around the associated annular member, two devices enabling materials used in the making of the tyre to be turned over around bead core assemblies held by the bead clamping devices, each turning device being carried respectively by one of the two annular members and consisting of several elements circumferentially distributed around the associated annular member and each being pivotable around an axis substantially parallel to a plane through the centre of the drum and normal to the axis thereof, each of the turning devices having at least one pivoting element comprising a pivoting arm connected at one end on to an associated annular member and made up of several flexible strips fixed at one end at a common point on to the associated bead clamp and at an opposite end at respective points spaced along the pivoting element.

4. A drum for making tyres with radial ply carcasses substantially as herein described with reference to and as illustrated in the accompanying drawings.

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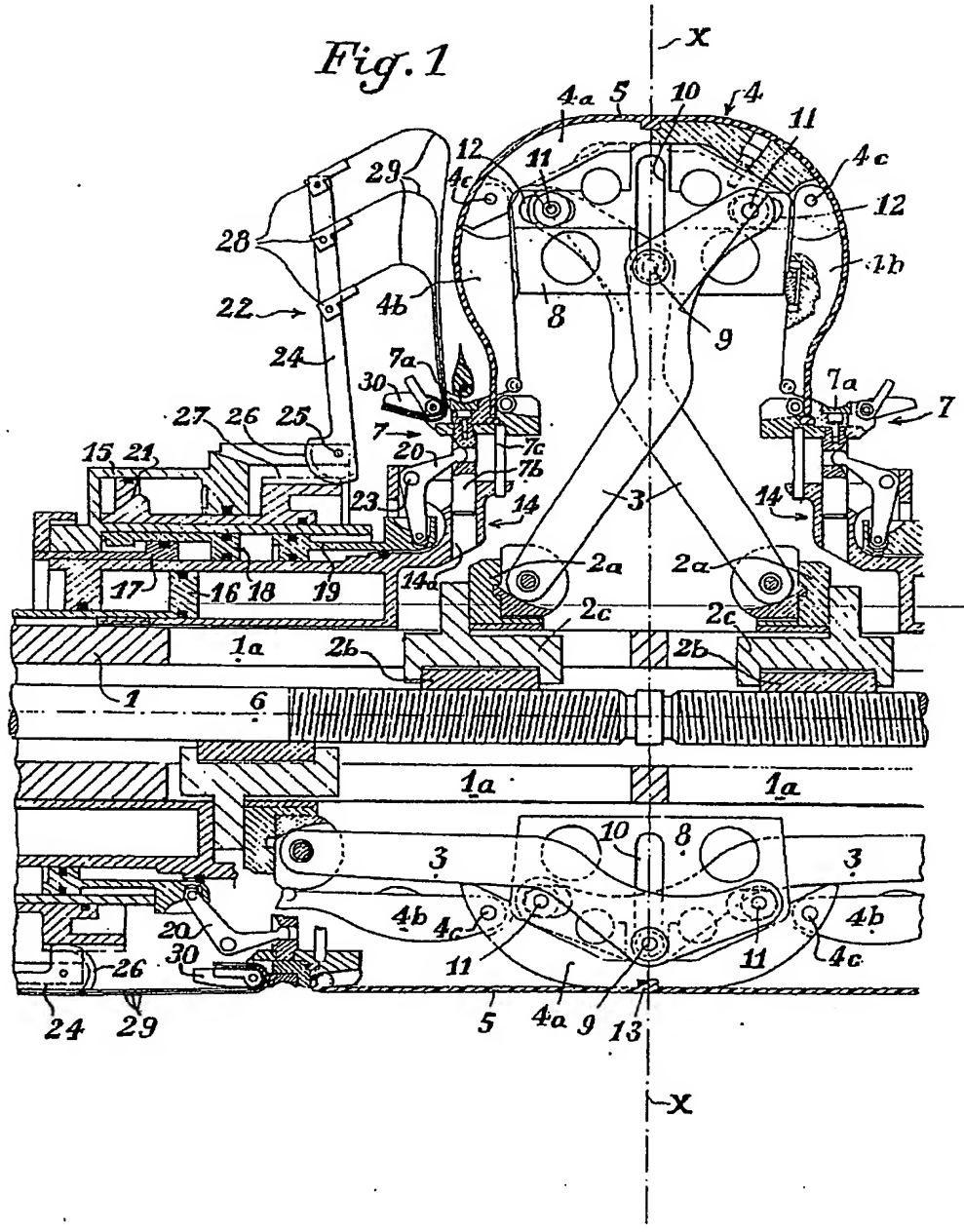
1 524 369 COMPLETE SPECIFICATION
2 SHEETS This drawing is a reproduction of the Original on a reduced scale.
SHEET 1

Fig. 1



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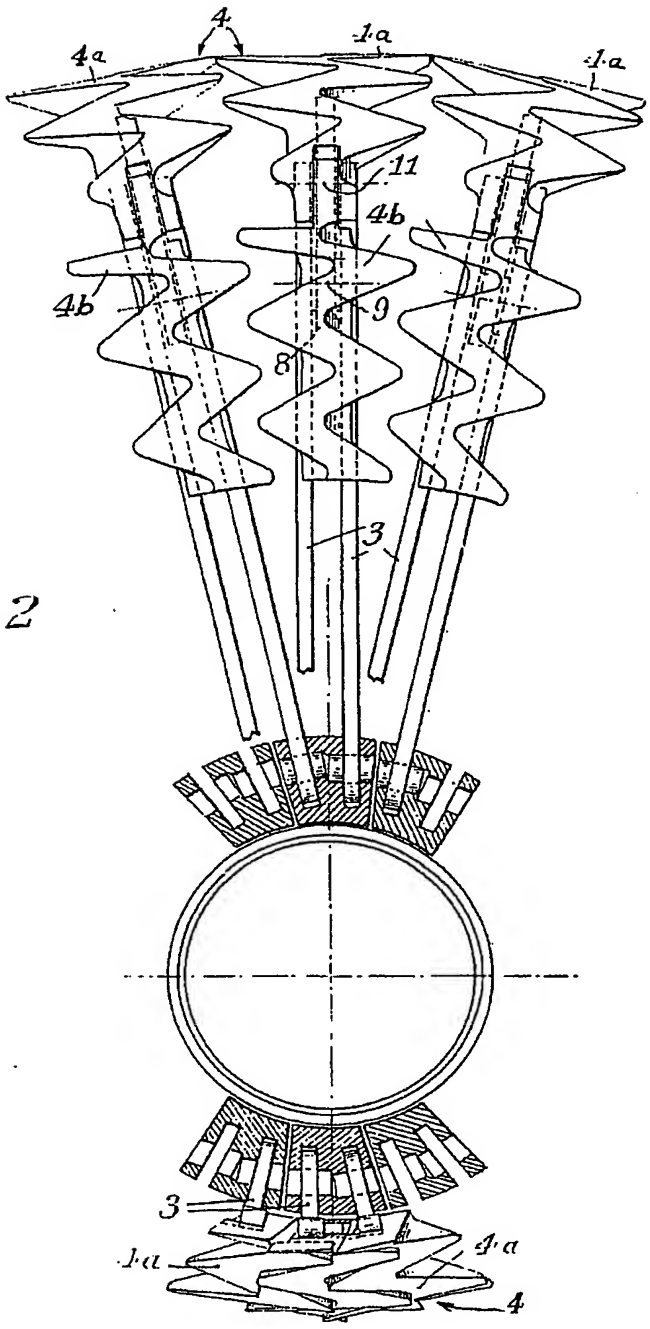

Fig. 2